

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-359

Anonymous Referee #1

Referee comment on "Measurement report: Fast photochemical production of peroxyacetyl nitrate (PAN) over the rural North China Plain during haze events in autumn" by Yulu Qiu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-359-RC1>, 2021

General Comments:

The authors provided an analysis for the sources of abrupt PAN enhancement at Shangdianzi (SDZ) station on Oct 20 and Oct 25, 2020. The influences from regional transport were evaluated using CO as an inert tracer; the contributions from various precursors are then calculated based on observations. The authors found CH₃CHO oxidation by OH is the major pathway of PAN formation at the SDZ site. I recommend the paper for publication after consideration of the points below.

Specific Comments:

- Improvements in the language are suggested.
- As shown in the title, the scientific importance of this paper relies on the validity of the conclusion to represent rural North China Plain during the cold season haze events. However, it is unclear whether the analysis based on a single station during pollution events (3 days) has enough representation.
- Lines 236-251: More details should be provided for the calculation in this section. The Phys is calculated with $dCO/dt * PAN/CO$ in Eq. 2. However, I assume Eq. 2 should consider PAN and CO along the transport pathway, particularly, the source domain, instead of SDZ site itself.
- Section 3.4: The authors indicated that the contribution from CH₃CHO oxidation by OH is larger than that from other precursors. I am wondering whether the total contributions from precursors can explain the observed PAN enhancement, quantitatively?

Technical Comments:

- Line 130-136: improvement in the language is suggested as continuous “In addition” and “Here” are used.
- Line 146: It seems Zhu et al. 2018 is not southern coast region.
- Line 163: which were 10.6 and 7.7 times *larger than* those during clean days.
- Line 213: the increases of PAN on pollution days *are* impossibly caused by direct PAN transport.
- Lines 214-215: rephrase this sentence: “Here, direct transport impact is restricted to PAN that has been formed in other regions, but exclusive of PAN precursors”.
- Line 228: what is “urban city”?
- Lines 240-241: rephrase this sentence: “It should be noted that the calculation of physical transport impact aims at PAN that has been formed outside of the SDZ site”.